Example #17: When a 6.0 V EMF battery was connected to a 15 Ω resistance, a current of 375 mA occurred and the voltmeter reading was 5.625 V.

(a) Find the internal resistance r of this supply.

(b) If this battery is now connected to a 5.0 Ω resistor, what current will flow?

a) $V_T = \mathcal{E} - Ir$ where V_T = voltmeter reading

$5.625 = 6.0 - .375\,r$

$\boxed{r = 1.0\ \Omega}$

b) $R_o = 5.0\ \Omega$

$V_T = \mathcal{E} - Ir$ and $V_T = IR_o$

so $IR_o = \mathcal{E} - Ir \Rightarrow \mathcal{E} = IR_o + Ir$

$\rightarrow I = \dfrac{\mathcal{E}}{R_o + r} = \dfrac{6}{5+1}$

$\boxed{I = 1.0\ A}$